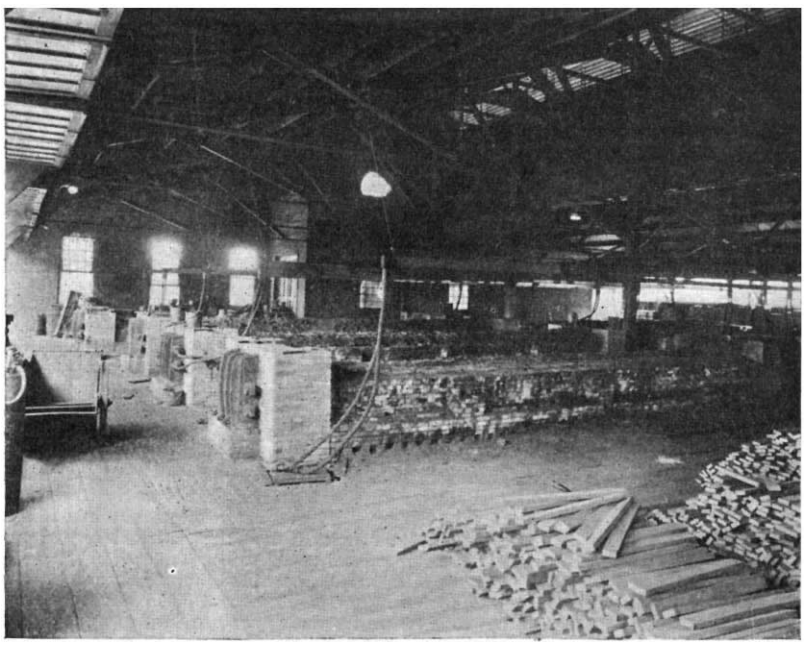
Acheson finds that it is not always desirable to convert the whole of the articles into graphite, but that if the operation is stopped when a portion is still ungraphitised they are stronger and less liable to fracture than when they consist of pure graphite.

It has already been mentioned that graphite of any desired purity can be obtained by this process, it simply being a question of how long the product is heated in the furnace. When it is to be ground and used as a lubricant it is necessary to make it of a higher degree of purity than when required for many other purposes; but, however pure the graphite, there are certain difficulties in employing it as a lubricant mixed with oil or water, owing to its precipitating out very shortly after being mixed with them. Although many attempts have been made to get over this difficulty, it is only quite recently that Acheson has been successful in doing so. In 1901, when experimenting upon the manufacture of crucibles, he found some difficulty in obtaining clay which had good binding qualities. He therefore commenced the study of clays which are used in the manufacture of crucibles. It



International Acheson Graphite Co., Niagara Falls, N.Y., U.S.A.

was noticed that American crucible makers imported the clay from Germany, because, although the clay has practically the same chemical constitution as the American product, it has a greater tensile strength and is more plastic. Acheson then noticed that clays found at or near to the place at which the felspar rocks are decomposed are not so plastic or strong as when obtained at a distance from their source of origin. It occurred to him that this might be due to their containing vegetable or organic extract matter.

Experiments were therefore undertaken upon the action of vegetable extract matter, such as tannin and plant extracts, upon various clays. Remarkable results were obtained, it being found that a weak and only moderately plastic clay, after treatment with a dilute solution of tannic acid or extract of straw, increased in plasticity and became much stronger. In some cases the increased strength was as much as 300 per cent., and only 60 per cent. as much water was required to produce a given degree of fluidity. It remained suspended in water, and would pass through a filter paper. Clay thus treated Acheson called "Egyptianised," because the "Children of Israel" used straw in making bricks.

Now as clay so treated would remain suspended in water, it occurred to Acheson that perhaps the fine, unctuous graphite which he succeeded in directly manufacturing in the electric furnace in 1906 would also remain suspended in water if thus treated.

When disintegrated, graphite is treated with water containing tannin, the weight of which was from 3 per cent. to 6 per cent. of the graphite employed. The graphite remains suspended in the water indefinitely, and passes through a fine filter paper; it is therefore in a semi-colloidal condition. Graphite so treated Acheson calls "*deflocculated.*" To cause complete deflocculation and the suspension of the whole of the graphite requires prolonged mastication in the form of a paste with water and tannin, and after this mastication it is improved by diluting with considerable water and allowing to remain some weeks, with occasional stirring. The addition of a very small quantity of hydrochloric acid causes flocculation and precipitation.

The graphite, even after it has been flocculated, is in so fine a state of division that when dried by evaporation *en masse* it forms a hard cake. It is self-binding, like clay, and when dried in the sun is like a black clod of clay.

This deflocculated graphite is a splendid lubricator, and may be used in place of oil. It was tested on a shaft measuring 25/16 inches in diameter, and running at 3000 revolutions per minute in a bearing 10 inches long. On the same shaft a similar bearing was lubricated with oil, and this ran much the warmer of the two. If water alone is used for lubricating, rusting ensues; no rusting takes place with deflocculated graphite. Deflocculated graphite can also be suspended in the dehydrated state in oil. The two products come on the market as "aquadag" and "oildag" (d-a-g = deflocculated Acheson graphite).

Aquadag has been found very satisfactory as a cutting compound in screw-cutting. It will be readily understood that, while preventing rust, the high specific heat of the water permits high speed of the machinery, and therefore increased output. One disadvantage of aquadag is the rapid evaporation of the water; consequently, for general lubricating purposes, oildag is of more value. For automobile lubrication, for example, oildag is stated to have proved much more efficient than oil without graphite. F. M. P.

THE FAUNA OF THE MAGELLAN REGION.[1]

IN 1892–3 Dr. W. Michaelsen conducted a zoological collecting expedition to the south end of South America, and was remarkably successful as regards booty. Descriptions of his collections began to appear in 1896, and they are now gathered together in three substantial volumes, each of several hundred pages. Dr. Michaelsen gives a lively account of his journeyings, and Prof. Dr. G. Pfeffer, of Hamburg, who persuaded some of his enlightened fellow-citizens to subsidise the expedition, refers briefly to the general bearing of the various contributions. It seems to us a matter for regret that there is no adequate summation of the results of the expedition, though we do not know what more Dr. Pfeffer could have done within the limits allotted to him. It is certainly

[1] "Ergebnisse der Hamburger Magalhaensischen Sammelreise 1892–93. Herausgegeben vom Naturhistorischen Museum zu Hamburg. Bd. i., Allgemeines, Chordonier, Echinodermen, und Cœlenteraten. Bd. ii., Arthropoden. Bd. iii., Bryozoen und Würmer. Not continuously paged; numerous plates (Hamburg: L. Friederichsen and Co., 1896–1907.)

very difficult to deal with a huge bundle of memoirs, by about forty different authorities, and bearing diverse dates from 1896 to 1907. We cannot do more than give a general indication of the contents of these volumes.

Dr. Paul Matschie reports on eight species of mammals, including a new mouse (*Acodon michaelseni*, n.sp.), and refers to a number of remarkable facts, such as the occurrence in the sub-Antarctic region of a cat (*Felis pajeros*) which closely resembles the Manul-cat of Central Asia. G. H. Martens discusses the birds, of which forty-two species were collected. He notes that 299 species (in 176 genera) are known to occur in the Antarctic and notial regions (south of a line between 42° and 43° S.), that of these 192 are confined to the western hemisphere and fifty-six to the eastern, while forty-eight are circumpolar. It is pointed out that about a third of the families of birds are represented in the southern polar region. We may direct attention to the statement that the Arctic tern is found as far south as 66°. Dr. Franz Werner describes two new iguanids from Chili—species of the genus Liolæmus—and a new batrachian, *Leptodactylus kreffti*, also Chilian. Prof. Einar Lönnberg deals with forty-six species of fishes, including *Etmopterus paessleri*, a new dog-fish. Prof. Michaelsen reports on the tunicates, describing some new forms, discussing the classification of Polyzoidæ, and showing that Paramolgula, Agnesia, Boltenia, and Synoicum are good instances of bipolar genera. The typical form of the pelagic *Fritillaria borealis* is found in the two polar regions, while other forms (*sargassi* and *intermedia*) are found in the tropics.

Prof. H. Ludwig makes an interesting comparison of Arctic and Antarctic holothurians. No Antarctic species occurs in the Arctic fauna; ten genera are represented at both poles; nine genera represented in the south are absent from the north; six genera represented in the north are absent from the south; of the ten genera represented at both poles, none is exclusively polar; two genera—Pseudopsolus and Theelia—are exclusively Antarctic; four genera—Eupyrgus, Trochoderma, Myriotrochus, and Acanthotrochus—are exclusively Arctic. It comes to this, that there is no special resemblance between Antarctic and Arctic holothurians; on the contrary, there is *great dissimilarity*. It is pointed out that ten forms showing "parental care" are now known, that six of these are peculiar to the Antarctic, and that each of the six has solved the problem in a fashion of its own. There is hermaphroditism in *Cucumaria crocea* and *Pseudopsolus macquariensis*, while in two synaptids (*Chiridota pisanii* and *Ch. contorta*) the sexes are separate. Dr. M. Meissner describes a new echinus from Gough Island, and takes a survey of the southern forms. He notes some illusory suggestions of bipolarity which he corrects later on; the fact is that there is little in common between north and south. Only one species of Antedon (*A. rhomboidea*) was obtained from the Magellan region, but Prof. Ludwig takes a survey of the known southern forms. He finds that the species of Antedon are in a general way like the northern species, but there is no bipolar species, and there are no northern counterparts of *Thaumatocrinus renovatus, Promachocrinus kerguelensis*, and *P. abyssorum*. In his report on the ophiuroids, Prof. Ludwig notes that although six genera occur in both polar regions, there is no bipolar species. Meissner discusses the asteroids, and notes that although fifteen genera are represented in both polar regions, there is no bipolar species. Dr. Walther May discusses the twenty-two species of alcyonarians from the Magellan region, including the three new species *Alcyonium paessleri, Metalcyonium patagonicum*, and *Virgularia kophameli*. Dr. Carlgren reports on the Zoantharia, describing many new species and establishing a number of new genera, Gondylanthus among Antheadæ, Isotealia, a Bunodid, Parantheoides, one of the Paractidæ. There is no clear case of bipolarity of species. An interesting fresh discovery is that of numerous brood-pouches (ectodermic invaginations of the body-wall) in *Condylactis georgiana*, the first case recorded among Antarctic Actiniaria.

The reports on Arthropoda make up a thick volume. In his account of the Hemiptera, G. Breddin establishes a new family to receive a somewhat isolated type, Peloridium; H. Schouteden describes two new aphids; Prof. A. Forel discusses three new ants, which are the most southerly representatives of their race as yet recorded; E. H. Rübsaamen reports on a remarkable new Pteromalid (*Aditrochus fagicolus*, n.g. et sp.), peculiar in structure and unique in making Cynipid-like galls on the leaves of the Antarctic beech, whereas all other gall-making Pteromalids, so far as is known, attack monocotyledons (orchids and grasses). Prof. H. Kolbe uses the beetles to support the theory of a connection through the Antarctic continent between the south of South America (Archiplata) and Australia (including New Zealand). Dr. O. Staudinger discusses the Lepidoptera of the Magellan region, and describes more than a score of new species. The small collections of Trichoptera and Ephemeridæ are reported on by G. Ulmer; Prof. Fr. Klapálek describes a few new Plecoptera; Dr. F. Ris has based his report on Odonata on more material than the collection afforded, and he has been able to show the striking contrast between the Atlantic and the Pacific sides as regards their dragon-flies. Dr. C. Schäffer had a large collection of Apterygota to deal with (including twenty-two new species), and he has established five new genera. He directs attention to the presence of a large number of European forms, *e.g.* species of Achorutes, in South America.

E. Simon deals with the spiders, many of which are new. He points out that the Clubionæ and Agelenidæ form more than half the whole arachnoid fauna in the Magellan region. In connection with *Bigois antarctica*, n.sp., he refers to the occurrence of the only other species, *B. pupa*, in the Philippines, "one of the strangest facts of geographical relations, of which no adequate explanation can be suggested at present." He also reports on a couple of scorpions, a book-scorpion, and two Opiliones. The Gonyleptidæ, or Opiliones Laniatores, are dealt with by W. Sörensen, and the mites by Prof. P. Kramer, who remarks on the absence of any characteristic Magellan genera. Dr. Carl Graf Attems reports on three myriopods—apparently the first to be recorded from the Magellan region. One of them is the widespread European and North American *Scolopendrella immaculata*; the second is a new species of Scolioplanes—a genus the representatives of which are known from Europe and the East Indies; the third is nearly allied to the European and north African species of Schendyla, but is made the type of a new subgenus, Schendyloides. It is thus evident that, so far as may be judged from these three species, the Magellan myriopods have close affinities with Palæarctic forms.

Mr. T. V. Hodgson describes three new species of pycnogonids belonging to the genera Nymphon, Tanystylum, Colossendeis; Dr. Carl Zimmer deals with a new species of Neomysis and six new Cumacea. Dr. W. Weltner discusses the Cirripedia, and compares the Arctic and Antarctic forms, showing that the seven genera and the four species which are represented both in the north and the south are cosmopolitan in their distribution. Of the fresh-water ostracods described by Dr. W. Vávra, three are European and cosmopolitan, and five new species belong to widely distributed genera. The same authority deals with the fresh-water Cladocera, of which four are new. Al. Mrázek discusses the fresh-water copepods, and lays emphasis on the distinctiveness of the southern Centropagidæ, among which Parabroteas, Lovenula, and the genera centred around Boeckella are especially characteristic.

L. Calvet reports on sixty-one species of marine Bryozoa, of which three are cosmopolitan, seven occur also in Arctic seas, and three others are sub-Arctic. Of the thirty-five genera represented, no fewer than twenty-five have Arctic as well as sub-Antarctic species. Thus, as regards *genera*, there is considerable resemblance between the north and the south, but a similar resemblance exists between the tropical littoral genera and those of the north or south. There is not much resemblance between north and south as regards *species* of Bryozoa, and it cannot be said that there are in the deep sea any connecting links between the Arctic and Antarctic contingents.

Dr. W. Fischer's short report on four Gephyrea is very interesting, for he shows that the Antarctic forms of Phascolosoma are simply varieties of the Arctic *Phascolosoma margaritaceum*, Sars, that *Priapulus caudatus* is

also bipolar, and that the southern *Echiurus chilensis* and *Priapuloides australis* have their counterparts in the northern *E. unicinctus* and *P. typicus*. Prof. R. Blanchard describes six new species of leeches belonging to the genera Trachelobdella (1), Helobdella (4), and Semiscolex (1). Mr. Frank E. Beddard deals with a large number of new Oligochæta. Thus he establishes a new genus of Limicolæ, Hesperodrilus, with four species, and among Terricolæ he describes thirteen new species of Acanthodrilus and eight of Microscolex. He regards the south of South America as the headquarters of these two genera, while the Geoscolecidæ and the genera Kerria and Ocnerodrilus are as distinctively northern. The collection included eight Lumbricidæ, which are all European species, and probably imported. Dr. Michaelsen also makes a report on the Terricolæ, adding some new forms and adjusting the names of others in accordance with his system of classification. Dr. H. Ude deals with the Enchytræidæ, and points out that the genera represented in the sub-Antarctic region, *e.g.* Enchytræus, Pachydrilus, and Marionina, are familiar European or even boreal genera. This indicates the world-wide distribution of an ancient fresh-water fauna. But, curiously enough, the genus Mesenchytræus is not represented at all in the Antarctic region.

Prof. Ernst Ehlers reports on the Magellan Polychæta—eighty-five species (thirty-six new) in fifty-five genera—and gives an interesting description of the general features of the polychæt fauna, such as the strong representation of Syllidæ and Phyllodocidæ. The following species occur in the boreal and notial regions, but not in the intermediate tropical and subtropical seas:—*Nephthys longisetosa, Glycera americana, Scolecolepis vulgaris, Arenicola assimilis,* and *Notomastus latericeus*. How this "bipolarity" is to be accounted for Prof. Ehlers does not say.

Dr. von Linstow has some very remarkable facts to relate regarding nematodes. Thus *Ascaris osculata* of northern Fissipedia occurs also in exclusively Antarctic forms, and *Ascaris adunca* occurs in northern and southern fishes the habitats of which in no way overlap. From cases like these, and from the character of the free-living nematodes, von Linstow argues that in past ages the conditions of life and evolution must have been more uniform over the earth, and the occurrence of types much more widespread. Dr. O. Steinhaus points out that four species of Chætognatha are common to the far north and the far south. As to nemerteans, Prof. O. Bürger directs attention to the complete absence of Protonemertini from southern waters, and to the occurrence of *Carinoma patagonica* in the Straits of Magellan—its only known congener being the rare *C. armandi* of the British coast. He thinks that the resemblance of the boreal and notial nemerteans is undeniable, so long as we fix our attention on genera.

Prof. Lönnberg remarks on the close resemblance between three southern cestodes and Scandinavian species. It is the similarity of host that counts. The northern host of *Bothridiotaenia erostris* is a gull or a fulmar; the southern host of the same is a penguin. Prof. Max Braun establishes a new genus of trematode, Lophocotyle, which ranks among the Monocotylidæ; Dr. Rudolf von Ritter-Záhony establishes two new genera of polyclads; and Prof. L. Böhmig describes three new rhabdocœlids and five new triclads.

It should be noted that most of the authors have increased the value of their contributions by including in their survey all the forms recorded from the Magellan region. As regards the question of "bipolar" distribution, to which most of them refer, the impression left on a reader's mind is that it is very difficult to generalise. It appears that the state of affairs differs in regard to different sets of animals. In some cases, *e.g.* holothurians, the dissimilarity of boreal and notial forms is more striking than the resemblance; in other cases, *e.g.* Bryozoa, there is a marked resemblance as to the genera represented at the two poles, but this does not extend to any identity of species; in a few cases, *e.g.* Gephyrea, the same species occur north and south, but some of the instances of this kind have to be discounted when the species in question (*e.g.* of Cirripedia) are cosmopolitan.

BOTANY AT THE BRITISH ASSOCIATION.

THE proceedings of Section K at Dublin, under the presidency of Dr. F. F. Blackman, were rather above than below the average standard of quality, and were characterised by more homogeneity than is usually the case, a large proportion of the papers dealing with certain aspects of physiological botany. Several of these dealt with those fields of investigation in which progress at present consists in the application of physico-chemical principles and quantitative methods to the experimental analysis of complex physiological phenomena into their component processes and factors.

The presidential address (NATURE, October 1, vol. lxxviii., p. 556), which was entitled "The Manifestations of the Principles of Chemical Mechanics in the Living Plant," dealt with this aspect of physiology, and urged the view that in some cases the internal metabolic changes of the organism which follow external changes should be regarded, not as reactions of protoplasm to stimulation, but as inevitable alterations of metabolic reaction-velocity.

Physiological Papers.

The death of individual cells as brought about by chemical poisons or high temperatures is a complex phenomenon, the experimental quantitative investigation of which leads to important biological conceptions. Two papers were communicated on this subject after the delivery of the presidential address. The first, by Miss Harriette Chick, dealt with the death-rate of bacteria under the action of disinfectants. When a crowd of similar bacteria are treated with any disinfectant they die off at such a rate that the "number surviving" after successive intervals of time fall into a logarithmic curve. The process of killing is thus continuous, and there is no definite time of exposure which can be said to be fatal. The killing goes on in a way that recalls the progress of a monomolecular reaction according to the "law of mass." It is shown that the different times of resistance of the bacteria are not due to permanent differences between the individuals, but that these differences are temporary and possibly phasic. Viewed in this way, the rate of killing is a phenomenon of reaction-velocity, and it is found that increase of temperature accelerates the reaction-velocity of disinfection just as it does that of a chemical reaction.

This paper was followed by one by Miss Nora Darwin and Dr. F. F. Blackman, dealing with the death-rate of cells of higher plants in fatal conditions. When it is realised that bacteria die off logarithmically under uniform unfavourable conditions, it becomes at once interesting to determine whether the cells of a tissue of a higher plant die in the same independent way, or whether their closer protoplasmic connection leads to their behaving all alike. Experiments on this point are being carried out with strips of potato, fuchsia stamens, and other organs, using the shortening of the tissue resulting from loss of cell-turgor on death as an indication of the progress of the death-rate. An optical lever was used to record the shortening, and submersion in hot water as the fatal condition. The cells of the tissue appear to behave like a number of bacteria, and to die off progressively and logarithmically, but this interpretation has yet to be firmly established. Seeds submerged in water at 42° C. to 50° C. exhibit clearly a logarithmic death-rate.

Other physiological papers were communicated on Thursday by Prof. H. H. Dixon, on the influence of living cells on the transpiration current, and by Prof. Bose, on the mechanical and electrical responses of plants. Prof. Dixon described experiments to show that there is no evidence of vital activity as a contributory factor in raising the transpiration current in a branch. The rate of transmission of water in a branch from above downwards was found to be the same before and after killing by steam or picric acid. The fading of leaves on a steam-killed branch is shown to be directly due to a poison liberated into the transpiration current by the dead cells, and is not to be taken as evidence that some preexisting vital raising force has been extinguished by the killing.

Prof. Bose gave a summary of his views on plant-responses as expounded in his recent books. His paper was